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(54) SLAG GRANULATING APPARATUS

(71) We, NIPPON KOKAN KABUSHIKI KAISHA, a corporation organised under the laws of Japan, of 2, 1-chome, Otemachi, Chiyoda ku, Tokyo, Japan; and RASA TRADING COMPANY, LTD., a corporation organised under the laws of Japan, of Yusen Kayabacho Building, 1—12, Nihonbashi Kayabacho, Chuo ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to slag granulating apparatus by which grains of slag suitable as cement material are produced from masses of slag, such as are produced in a blast furnace.

The invention provides slag granulating apparatus comprising an agitating tank, a number of water discharge nozzles arranged around the tank above the bottom thereof to direct water into the interior of the tank from all sides thereof, an inflow channel for slag above the level of the water discharge nozzles, an outflow channel at the bottom of the tank, whereby the slag is broken up by the action of water jets incident on said slag as it falls from the inflow channel to the outflow channel, and a separator for receiving the mixture of water and broken up slag delivered from the outflow channel, said separator having mesh walls through which water may flow out of broken up slag, thereby separating the broken up slag from the water.

In order that the invention may be more clearly understood, embodiments of it will now be described by way of example, with reference to the accompanying diagrammatic drawings, in which:

Fig. 1 shows schematically a slag granulating apparatus in accordance with the present invention;

Fig. 2 is a view partly in cross-section showing a separator of the apparatus of Fig. 1;

Fig. 3 shows a modified form of separator; and

Fig. 4 is a fragmentary view of an enlarged scale showing a portion of another modified form of separator.

Referring to the drawings, a reservoir 1 for circulating water is disposed so as to receive water from a water source 2 located in an elevated position through duct 3 and valve V_1. From the reservoir 1, and by means of a pump 5, water is supplied to a plurality of water discharging nozzles 8 which are arranged around, and directed toward the interior of, an agitating tank 7 of cylindrical form. Optionally, water can be simultaneously supplied through a conduit 6 to channels 10 referred to below.

In order to increase the pressure of the water to be discharged from the nozzles 8, a valve V_2 is installed on the outlet side of the pump 5. This valve V_2 is kept closed for a little while after the apparatus is set operating and by opening the valve a desired pressure can be provided to the discharging water. In an intermediate portion of the duct 6 a pressure gauge 9 is provided for measuring precise water pressure.

Channels 10 connected to the agitating tank 7 deliver into tank 7 sponge-like slag run off from a blast furnace. By the pressure of the water discharged from the nozzles 8, the sponge-like masses of slag passed into the agitating tank 7 are readily broken to small grains and a mixture of water and minutely broken grains of slag, for example 1 to 3 millimeters in diameter, is thus formed in said tank 7. Overflow conduits 32 and 33 lead from the upper portions of the agitating tank 7 and the reservoir 1 respectively.

Extending from the bottom portion of the agitating tank 7 is an outflow channel 11 through which the mixture of slag and water within the tank is pumped into the upper portion of a dehydrating separator 12 by means of a sand pump 31. A water supply conduit 26 is fed from the water supply to the nozzles 8 through a valve V_3, which when opened provides water to the sand pump 31 thereby helping to initiate its operation.

Details of the slag dehydrating separator are shown in Fig. 2. There is provided a con-

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tainer 16 comprising an upper end portion which has an inlet 13 for receiving the mixture of slag and water passed forward by the sand pump 31, a bottom portion having a shutter 15 and a hopper equipped with a vibration generator 14, and side walls formed of iron net with a suitable mesh. By means of a flange portion 17 provided around the external circumferential surface of the container 16 and bolts 20, the container is mounted through interposed cushions 19 on a stationary supporting frame 18 so as to be vibratable. Accordingly, by driving the aforementioned vibration generator 14, the hopper portion 4 of the container 16 can be vibrated on the stationary supporting member 18 thereby preventing slag from clogging up the hopper portion during the water removing operation.

Surrounding the external circumferential surface of the container 16 are annular troughs 27 for receiving water which flows out through the meshes of the container 16, said troughs being suitably spaced apart vertically. Furthermore, the troughs 27 communicate with one another by means of connecting pipes 28 and the lowermost trough is further connected to a circulation tank 30 by a circulation channel 29 (see also Fig. 1). The water which flows out from the container 16 is thus sent to the circulation tank 30 through the circulation channel 29, and is then passed through a filter 21 into an adjacent deposit tank 22, where impurities are deposited, and the water is then returned to the reservoir 1 from where it is delivered into the system once again by the pump 5.

When a predetermined amount of water-drained slag has accumulated in the container 16 of the separator, the shutter is opened to drop the slag onto the loading platform of a truck or the like waiting below the shutter. Water left in the hopper portion 14 is drained by a drainage pipe 34 and the removal of water is thus completed within the hopper.

It can be seen that in the embodiment described, sponge-like masses of slag-containing foam sent out from a blast furnace are agitated and made into a mixture of grains of slag and water by use of a relatively small amount of ciriculating water, and the mixture thus obtained is passed into a vibrating container for drainage and separation in which the slag is separated from water, the water removed being further filtered to be re-used as circulating water. Uninterrupted and effective slag extracting operation can be achieved.

Furthermore, extracted in grains of approximately uniform size, for example 1 to 3 mms in diameter, slag processed as described makes an excellent cement material which is extremely economical in that what was previously a waste product is now made commercially valuable.

In order to facilitate the removal of any small particles of slag which may clog up the meshes of the container 16, the apparatus of Fig. 2 can be modified as shown in Fig. 3, where a number of water discharging nozzles 24 are disposed around, and directed toward, the external circumferential surface of the container 16, said nozzles 24 being connected to the previously mentioned conduit 6 through a valve V_4. By opening the valve V_4, pressurized water can be discharged against the external circumferential surface of the container to remove the slag grains clogging up the meshes.

To facilitate cleaning of the iron net of the container 16, the present invention may be modified as shown in Fig. 4, in which the iron net portion is divided into quadrilateral sections 36 of a suitable size which are secured in detachaable manner between upper and lower rails 35 forming frames of the container. By removing these sections, the iron net can readily be cleaned, or, in case a portion of the net is damaged, the section which includes the broken portion can be individually replaced, thus facilitating a repair work.

The described slag extracting apparatus is simple in construction and easy to maintain.

WHAT WE CLAIM IS:—

1. Slag granulating apparatus comprising an agitating tank, a number of water discharge nozzles arranged around the tank above the bottom thereof to direct water into the interior of the tank from all sides thereof, an inflow channel for slag above the level of the water discharge nozzles, an outflow channel at the bottom of the tank, whereby the slag is broken up by the action of water jets incident on said slag as it falls from the inflow channel to the outflow channel, and a separator for receiving the mixture of water and broken up slag delivered from the outflow channel, said separator having mesh walls through which water may flow out of broken up slag, thereby separating the broken up slag from the water.

2. Apparatus according to claim 1, in which the separator is adapted to be vibrated.

3. Apparatus according to claim 1 or 2, comprising means for circulating the water separated by said separator into a reservoir through a filter from which reservoir the water is delivered to said discharging nozzles.

4. Apparatus according to claim 3, in which the separator has a shutter in a bottom portion thereof and troughs for receiving and guiding to said circulation means water flowing out through said mesh walls.

5. Apparatus according to claim 4, wherein said separator comprises an upper portion provided with an inlet for receiving the mixture of water and slag, a lower portion including a hopper equipped with said shutter and a vibration generator, and a circumferential flange portion by means of which the

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separator is vibratably mounted on stationary support means, whereby said separator is adapted to be set vibrating on said stationary support means by actuating said vibration generator.

6. Apparatus according to any one of claims 1 to 5, comprising a number of water discharging nozzles directed towards the mesh walls whereby particles of slag clogging the mesh walls may be readily removed.

7. Apparatus according to any one of claims 1 to 6, wherein the mesh walls are divided into quadrilateral sections of a suitable size which are secured to frame members of the separator in detachable manner.

8. Slag granulating apparatus constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.

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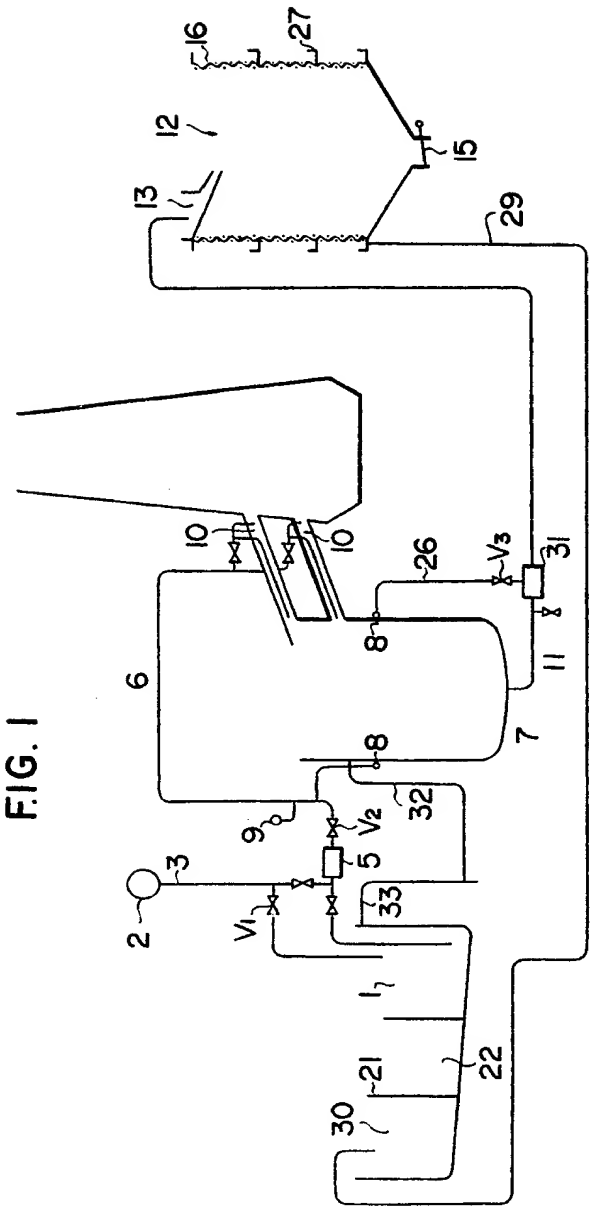

FIG. 1

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FIG.2

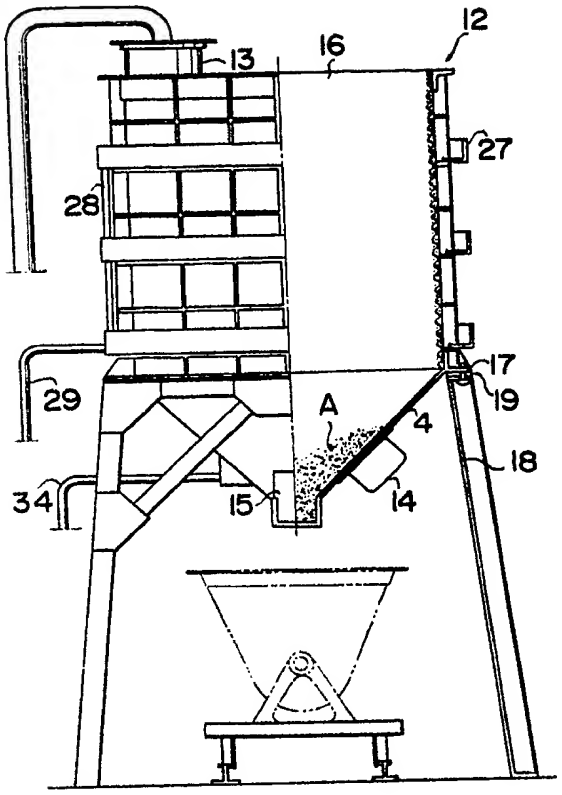

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FIG. 3

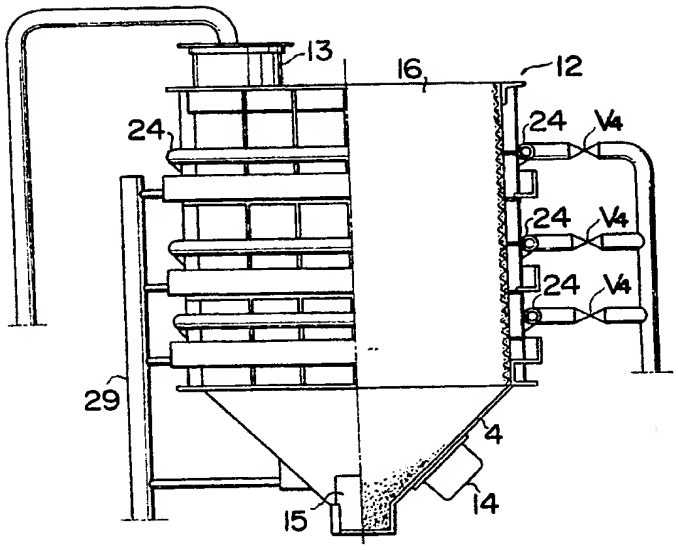
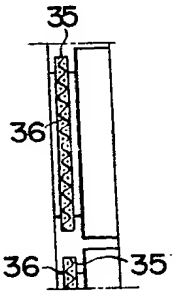


FIG. 4



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